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Measurement of Visibility and Present Weather Detection Using Scattering Technique of Light

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Abstract: *A forward-scatter meter measures a small portion of light scattered out of a light beam into a relatively narrow band of scattering angles. The forward-scatter meter measurement is then used to estimate the extinction coefficient; the scattered signal is assumed to be proportional to the extinction coefficient.*

Keywords*: visibility, weather detection, moisture detector, scattering technique, detection*

I. Introduction

Particle scatter function, the response of a forward-scatter meter depends upon fraction of light scattered into the range of angles detected. Since particles of different types have different scatter functions, the ratio of scattered signal to extinction coefficient (I.E. The Forward-Scatter Meter Calibration Factor) can depend upon the type of scattering particles. One way of addressing this problem is to select a scattering angle where scatter function is as closely proportional as possible to the extinction coefficient for the weather phenomena that reduce visibility into the Rvr Range. Another approach is to identify the weather phenomena and apply a different calibration to different weather types.

II. Ease of Use

A. Easy to detect fog, visibility andparticle

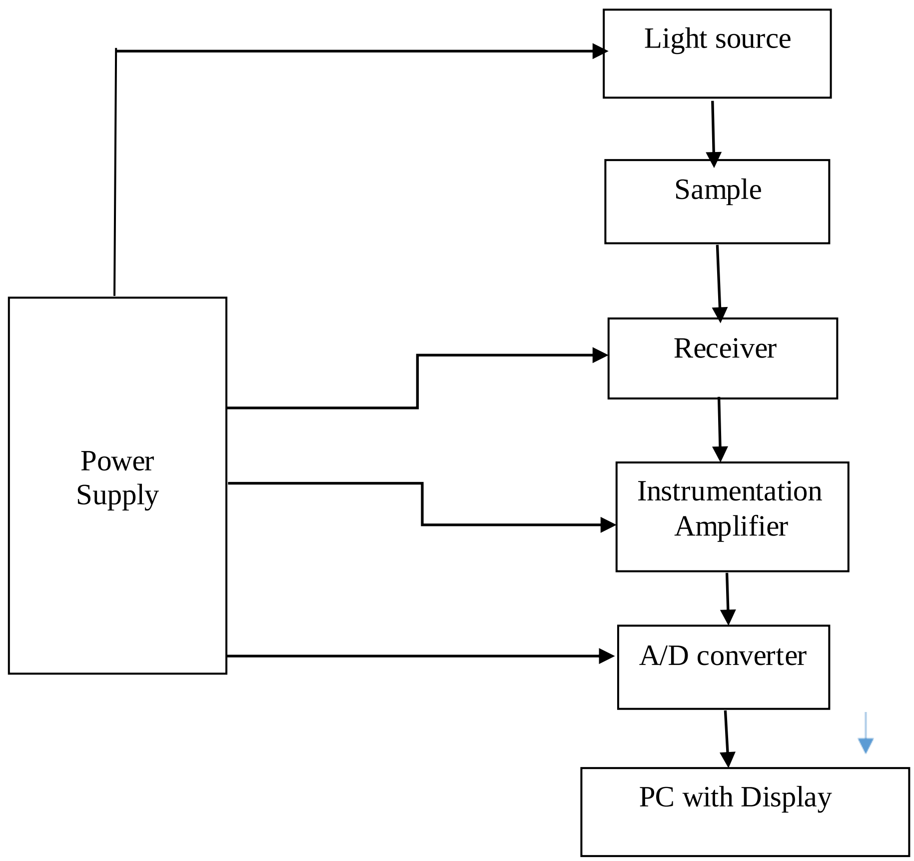
The fog, visibility and dust particle can be measure by using forward-scatter meter signal and the extinction coefficient are proportional to the particle density, variations in particle density cannot affect the validity of the forward-scatter meter measurement.

B. Maintaining cost of the system

By using the Infrared led the cost should be increase, and using the switch mode power supply the system should be bulkier, in case of condition the IR led damaged the cost of the led is costlier than another one. By using the mechanical parts to detecting the parameters the mechanical loss is more and to find the many particle there are more mechanical damages.

III. RelatedWork

A. Block diagram of system



The light emitted by source is non-uniform in the nature. A flashing circuit is used so as to get constant intensity and uniform light at predefined duration of time. The source consists: An electronic control circuit, and light source. Light emitted from the source is scattered into different direction. With the help of optical lens the source light is concentrated into a narrow beam. It helps to reach the light at the receiver. The white LED is used as a light emitter source.To keep the intensity of lightuniform an optical feedback system is used, it maintains light output constant by sampling the light beam continuously. A flashing circuit with 1 second interval is used to differentiate signal from the source and background light. Detector detects the scattered light from the source. The particles have tendency to scatter at different angles. The light strikes with the particle and get scattered. Different particles have different angles of scattering like fogwho gets maximum scattered light around 40-degree, 180-degree rain particles, also dust and snow particles can be detected at different angles. The received light signal is amplified using amplifier. An Analog to Digital converter is used to convert data into digital signal. This signal is then converted into RVR which indicates the visibility in meter.

IV. Specification of The System

- Source: White LED. A collimated beam of light isused as asource.
- Detector: High intensityphotodiode.
- Amplification Stage: Instrumentation amplifier.
- Analog to digital converter.

- Flashing circuit: IC74HC14
- Supply voltage: 0.5 V to + 7.0, High noiseimmunity.
- Operating temperature: -55 ºC to 125ºC.

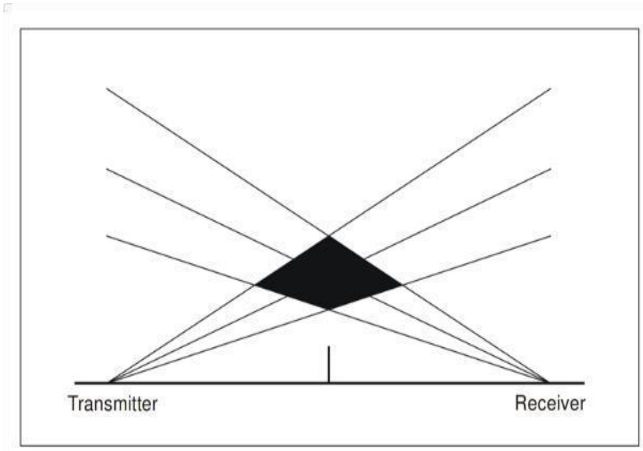


Fig (1)Block diagram of liquid level control

Fig. 1. The forward scatter sensor measures the scattered light and find visibilityfromscatteredlightwhichwegetwhenlighttravelsfromsourceto receiver. Scientifically called a nephelometer, a forward scatter sensor measurestheamountoflightscatteredatangleslessthan90degreesbysmall particulates suspended in, or large particles passing through its sample volume.Theamountofscatteringisrelatedtothequantityofparticlesinthe volume of air being sampled. The source is light emitting diode fall in IR or visible region having fixed intensity. The receiver is not in front of source but at an angle of say 50 degree from the source. The photo diode shall be very sensitive to detect scattered light. Detected voltage may be micro /milli volts. This shall be amplified to get in voltage for that instrumentation amplifier is used with dc cut off. The A/D converter is used convert analog output into digital. If V is the voltage from the photo diode with associated amplifier, then Visibility = K /Voltage.

V. Result Analysis

We will get present weather detection and visibility in terms of meters that is called as Runway visual range (RVR) and displayed on data acquisition software built in Lab View environment.

Atmospheric condition	Voltage measured	Visibility (in meters)
clear	265	7541
Smoke	928	5154
Dust	564	3542

VI. Conclusion

In this project we have to be studied the forward scattering technique of light using for present weather detection technique and measure the particles.

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